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Macroscopic Optomechanically Induced Transparency JACOB PATE, ALESSANDRO CASTELLI, LUIS MARTINEZ, JOHNATHON THOMPSON, RAY CHIAO, JAY SHARPING, Univ of California - Merced — Optomechanically induced transparency (OMIT) is an effect wherein the spectrum of a cavity resonance is modified through interference between coupled excitation pathways. In this work we investigate a macroscopic, 3D microwave, superconducting radio frequency (SRF) cavity incorporating a niobium-coated, silicon-nitride membrane as the flexible boundary. The boundary supports acoustic vibrational resonances, which lead to coupling with the microwave resonances of the SRF cavity. The theoretical development and physical understanding of OMIT for our macroscopic SRF cavity is the same as that for other recently-reported OMIT systems despite vastly different optomechanical coupling factors and device sizes. Our mechanical oscillator has a coupling factor of $g_0 = 2\pi \cdot 1 \times 10^{-5}$ Hz and is roughly ≈ 38 mm in diameter. The $Q = 5 \times 10^7$ for the SRF cavity allows probing of optomechanical effects in the resolved sideband regime.

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